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Where Do People Drown? Encoding the Third Component of the 4W Model

Stathis Avramidis, Ronald Butterly, and David Llewellyn

When there is human activity in, above, or around an aquatic environment, a drowning incident may occur due to rescuer characteristics, casualty characteristics, location, and general circumstances (Avramidis, Butterly, & Llewellyn, 2007). The aim of the current study was to identify locations where people drown. Qualitative content analysis was used to analyze drowning incident videos (n = 41), and semistructured interviews were conducted of those involved in drowning incidents (n = 34). Drowning incidents may occur in any aquatic environment with a water depth that allows immersion or submersion, under a variety of environmental conditions where the ground is sloping, at any distance from safety, where anxiety exists, in the absence of safety regulations, or when the law is breached. ***Keyword*s: drowning, lifeguarding, lifesaving, water safety, swimming, rescues**

Drowning is a leading cause of accidental death and a serious social and health problem worldwide (Avramidis & Butterly, 2008; World Health Organization, 2003). According to the 4W model of drowning, the place of occurrence of a drowning incident is an important factor in determining the outcome of the casualty (Avramidis, Butterly, & Llewellyn, 2007), but where people actually drown is largely uncertain.

Consequences of Aquatic Locations

Lack of understanding of where a drowning incident might occur has a several potential adverse consequences. First, it may increase the likelihood that a drowning death might occur (Avramidis & Butterly, 2008). Second, regardless of whether the casualty survives or not, rescues often incur a significant financial burden due to the use of rescue vehicles such as ATVs, helicopters, or ambulances (Muller, 2002; Vandevelde, 2002) and treatment costs (e.g., hospitalization; Ellis & Trent, 1995; Walters, Fraser, & Alleyne, 1993). Third, during the rescue, other people's lives might be placed at risk (e.g., amateur lifesavers, professional lifeguards or rescuers; Avramidis & Avramidou, 2008; Jones, 1985; Raphael et al., 1983; Shepherd & Hodgkinson, 1990). Fourth, the local authorities or the lifeguards might be liable for negligence that could result in litigation (Kozlowski, 1992; Mone, 1980; Morizot, 2002b). Fifth, the aquatic facility might be closed to

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investigate the cause of drowning, which may in turn result in unemployment for associated aquatic professionals (e.g., BBC1, 2000).

Taking the significance of the above negative consequences together, some of the important questions that may arise are the following: Where is it likely a drowning incident occurs? Are there any aquatic environments more likely to host drowning events than others? Is the actual location of the incident most important to know to avoid drowning or are there also other factors related to the *where*? Do the specific geographical characteristics of a country constitute a variable worth considering in the prevention of drowning? Do other variables play a vital role in our understanding of the place of occurrence of drowning?

Aquatic Environments

The aquatic environment in which drowning can take place includes numerous aquatic locations. More precisely, research has shown that people drown in open water (Lifesaving Society, 2000; Mackie, 1999; Water Safety New Zealand, 2003); in inland water (Bierens et al., 1996; Nichter & Everett, 1993; Pearn et al., 1976; Royal Life Saving Society Australia, 2001b; Water Safety New Zealand, 2003); in public or home swimming pools (Mackie, 1999; Victorian Injury Surveillance System, 1990); in water parks (Raging Waters, 2001); in residential hot tubs, spas, and whirlpools (Shinaberger et al., 1990; Royal Life Saving Society Australia, 2001b); in waterholes, dams, and garden ponds (Pearn et al., 1976; Royal Society for the Prevention of Accidents, 2001); in unattended buckets even partially filled with water (Department of Trade Industry, 1996); and in bath tubs and even toilets (Pearn et al., 1976, 1979; Petridou & Klimentopoulou, 2006; Quan et al., 1989).

Geography and Shape of Aquatic Environments

The geographical characteristics of a country might be a second cause of drowning. For example, countries such as New Zealand and Greece are surrounded by and contain a wide variety of aquatic environments that provide outstanding opportunities for aquatic recreational and sporting activities (Avramidis, 1998; Water Safety New Zealand, 2000). The more water in an environment the greater the likelihood of increased number of drowning incidents. No research has yet related the number of drowning incidents to the number of the kilometers of a country's coast line, the total diameter or area of inland lakes, or the total length of all rivers.

The size and the shape of the aquatic environment might be related to the incidence of drowning. People supposedly can drown in as little as 2 cm of water depth (Ridder, Hoofwijk, Dijk, & Hemmes, 2002). In terms of the distance from safety, 42% of drownings occur within 2 m of safety and 55% within 3 m, and 90% of all drowning deaths occur within 10 m of safety (Orlowski & Szpilman, 2001). Many drownings occur in water only just deeper than the person's height (Stallman, 2008; Stallman, Junge, & Blixt, 2008). In terms of the water density, people can drown in fresh water (Lifesaving Society, 2000; Orlowski, 1987) and even in the extremely buoyant water of the Dead Sea that has high density due to the salt content (Yagil, Etzion, & Oren, 1983).

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In terms of beach gradient, a steeply sloping beach can increase the likelihood of drowning incidents (e.g., Pia, 1970). The width of the supervised aquatic area allows only a maximum safe distance to scan of 106 m, while the largest area to scan safely is 9.334 m^2 and the farthest distance that should safely be scanned is up to 85 m (Fenner & Harrison, 2002). When considering the shape of the supervised area, although approximately 100,000 pools are designed and constructed annually worldwide with varied shapes and sizes (Mittelstaedt, 1992), no research has yet correlated drowning with the shape of a pool even though a pool shape can cause "blind spots" for the lifeguard, which can lead to drowning accidents.

Other Environmental Factors

Lighting, heating, glare and reflection are indoor causes also likely to lead to drowning. Lighting can influence the safety of bathers. There must be adequate visibility for bathers and lifeguards to move around and supervise the aquatic activities (Schwartz, 1998). No study has yet related drowning with the available lighting around the aquatic environment. It would be interesting to examine this variable as a possible contributing cause of drowning. Heating plays a major role in relation to the levels of attention of lifeguards and other supervisors, as it can influence the level of vigilance. Anecdotal information reveals that the lifeguards are less vigilant when the environment is very warm. Glare and reflection can affect the view of lifeguards, and therefore it should be minimized so a lifeguard can see a submerged swimmer on the pool bottom (Schwartz, 1998). The same applies to the sea or inland bodies of water when the sun shines from the south in the afternoon and creates a glare that shines in the eyes of the lifeguard who is looking in that direction (Brons, 2006).

Outdoor Aquatic Environmental Factors

A number of outdoor causes are also likely to lead to drowning. First, inland flooding is the number one weather-related killer worldwide (Ray, 2006), but it has been underestimated because drownings resulting from floods and natural disasters usually are not coded as drownings but as natural disasters (Smith, 2006). Terrorist groups killed fewer than 10,000 people worldwide from 1980 to 1999, while in 1998 alone, nearly 100,000 perished in floods worldwide (Greenhalgh, 1997). The second cause, excessive and torrential rain, relates to floods and therefore can kill many people at the same time. In 2000, 12 people died and 8,000 were forced from their homes in the USA as extremely heavy rains continued.

A large wave (e.g., tsunami) can be the cause of drowning deaths on a very large scale. The earthquake of 2004 that generated the great Indian Ocean tsunami led to more than 150,000 deaths (National Geographic, 2005). Fifth, in tidal waters at midtide, the water level will be rising at its fastest and could rise 1.5 m in 30 min, which would be critical for those unable to move away, such as unattended children on a beach (Whatling, 1994). Unsuspecting poor or weak swimmers can suddenly find themselves in difficulty in the same spot they safely played in earlier (Lifesaving Society, 1999). The sixth outdoor cause is the presence of a rip current (e.g., on Memorial Day 1990, 5 people died and 20 survived when rough ocean conditions and strong winds caused rip currents to form immediately offshore, making this one of the worst drowning episodes in Florida's history; Branche et al., 2001).

The third cause, heat, has been found to negatively influence both bathers and lifeguards, increasing the chances for drowning for different reasons. In particular, temperatures over 30° C significantly reduce vigilance by approximately 45% with respect to optimal performance (see Coblentz, Mollard, & Cabon, 2001). On the other hand, a high number of drowning incidents have been reported during warm months (Royal Society for the Prevention of Accidents, 2001; Tapadinhas, Anselmo, Rocha, Barros, & Maio, 2002) where thousands of people go swimming.

Seventh, many mysterious drownings may be caused by carbon monoxide emissions from boat engines and generators (e.g., in 1990–2003 in 26 American states, 94 people died and 77 were rendered unconscious; United Press International, 2003). Cold water can cause immediate death due to the cold shock response (British Defense, 1990; Golden & Hardcastle, 1982; Golden & Tipton, 2002) and hasten the process of drowning because it reduces the period during which a person is conscious (Groneng, 2006). Finally, off shore winds can push inflatables and their passengers away from beaches (Avramidis, 1998), and wind speed and direction are therefore critical to safety (World Health Organization, 2003).

Psychological and Social Factors Related to Place and Drowning

Psychological factors can be another risk factor for drowning incidents. For example, untrained people witnessing a drowning incident may avoid becoming involved and possibly prevent trained lifeguards from initiating rescue because they fear taking responsibility (Royal Life Saving Society Australia, 1992). People may also voluntarily take risks due to social pressures, as case reports show that people tend to initiate things that others ask them to do (e.g., nonswimmers jump in the water from a height, unguarded children swim and race; Royal Life Saving Society UK, n.d.), or drown while attempting to rescue others (Mackie, 1999). Third, the noise during lifeguard scanning constitutes a potential distracting factor for lifeguards (Coblentz et al., 2001; Ellis and Associates & Poseidon Technologies, 2001), especially in indoor aquatic environments. In an overcrowded and noisy swimming pool, the lifeguard becomes less effective.

Political Implications

A number of political issues such as the presence or absence of preventive measures, regulations, safety precautions, and legislation are also likely to lead to drowning. Several aquatic facilities cannot operate due to the shortage of available lifeguards (Griffiths 2001b). Another issue is the lack of standardized international signs, flags, and symbols to warn bathers of a phenomenon that can threaten their life. Warning signs should not have words, because they can benefit only those who speak the language of the host country (Morizot, 2002a; Sims, 2006).

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The lack of international signs could therefore be a potential cause of unintentional drowning mostly for international visitors to the aquatic facility. A third issue is that the law does not require guards at certain aquatic facilities (e.g., hotel or motel pools; Griffiths, 2001a). Fourth, although life jackets must be carried on civilian aircraft and boats, there is no regulation requiring them to actually be worn during flights or cruises (Green, 1995; Leese, n.d.). Fifth, a pool fencing regulation is very important; every year hundreds of young children drown due to submersion in residential swimming pools (United States Consumer Product Safety Commission, n.d.). A final issue is the easy availability of certain kinds of equipment (e.g., the European Union has prohibited the use and selling of some kinds of inflatables for young children; however, some local markets and beach-shops still do sell them; Adesmeftos Typos, 2002).

Establishing more clearly where drowning incidents occur may enable aquatic safety professionals to develop their accident prevention or rescue intervention plans. It will help lifesaving organizations to update their existing knowledge about the most potentially dangerous places for a drowning incident and adapt their lifeguard training and general public water safety programs accordingly. It will also help local authorities to be better prepared in accident prevention, rescue, and treatment. Two studies were therefore undertaken to investigate where people are likely to drown. The methodology of both studies was consistent with our previous published papers (Avramidis, Butterly, & Llewellyn, 2007, 2009).

Method

Study 1

Data Sources. We used a criterion-sampling method (Patton, 1990) to obtain drowning-incident videos ($n = 41$) that were freely available in the public domain (BBC1, 2000, 2001, 2002; ITV, 2001; Mega Channel, 2001, 2002a, 2002b; Pia, 1970; Royal National Lifeboat Institution, 1994; Twenty First Century Films Production, 1998; Waga News, 2001). This method facilitated the identification of variables and their relations that would not otherwise be available for fatal or nonfatal traumatic drowning events. These visual narratives ranged in length from 30 to 720 s ($M = 345.0$, $SD = 2.8$).

Apparatus and Procedures. The authors observed the videos using a JVC television (CM31720–003) and a Panasonic videocassette recorder (AG-MD830). We watched videos and reduced data using NVIVO software (QSR, 2002) to perform appropriate qualitative analysis. One of the first things established was the length of each video narrative, because the aquatic emergencies were usually on video cassettes that contained other audiovisual narratives; therefore, it was not always clear when each narrative started and ended. This had to be defined to guarantee reliable and objective measurements during the two independent observations. The reset time button of the VCR was pressed as soon as the first visual or audio message related to the aquatic emergency appeared on the screen. For example, in some videos, the audio narrative started before the actual visual portion, and in other cases, the visual video started before the audio narrative. In all cases, the actual start point of the video was determined to be the appearance of the very first visual scene or audio narrative on the video. In cases where the video was connected with transition effects (e.g., fade in) with the next or preceding video segment on the tape, the starting and finishing points were when the whole scene covered the whole TV screen.

As soon as the start and end points of the video were established, we watched the videotapes in real time so that we could get overall impressions of the aquatic emergency and take rough notes. We then noted the objective and subjective content of the video. Objective content was defined as the observations of audio or visual information on which every person watching the video would agree (e.g., the type of rescue a lifeguard did, the aquatic environment in which the drowning occurred, what people said). We avoided recording unsupported assumptions and editorial comments. (An example of an objective description is "Mr. L.H. was immersed in the river. Mrs. L. McD was shouting to him to hold on to the collar of the dog that approached to rescue him." We avoided reporting that Mr. L.H. could not hear Mrs. L. McD because he was deaf or saying that the dog that rescued him was a Newfoundland unless those things were confirmed as facts on the video.)

We defined subjective content of records as the responsive interpretations of the psychosocial dynamics of the scene. Subjective content might be information that could vary depending upon the number of times that the researcher observed the video or could be influenced by their age, gender, or personal history. (An example of subjective content might have included different interpretations persons might have drawn such as "After being saved by the dog, Mr. L.H. was very scared" or "After being saved by the dog, Mr. L.H. appeared to be depressed." A researcher's observations could therefore be influenced by his or her own age, gender, personal experiences, and number of times viewing the video.) The researcher could misunderstand what was being observed, resulting in mistaken interpretations of the situation (Gratton & Jones, 2004).

To minimize observer bias, we observed each video twice during a period of three months. Any information that was common across each observation was recorded and saved as the final narrative. During the two independent observations, each story was transcribed twice, first to analyze all the audio messages in the video and second to describe what could actually be seen. This ensured that enough information about each story would be available for analysis instead of relying completely on the narrator's comments. Finally, each aquatic emergency narrative was divided into manageable sections (30 s long) so specific observations could be precisely located in the transcribed text. NVIVO also allowed the notation of the exact location of the coded text in the transcribed narrative by document number, paragraph, and line (Rich & Chalfen, 1999). Because the participants of the current study were the casualties shown in the videos, they had no direct communication with the researcher, and therefore threats to reliability such as participant error and participant bias were not present (Gratton & Jones, 2004).

Once the transcriptions were complete, they were converted into Rich Text Format (.rtf) files and imported into the software NVivo. NVivo and all the procedures that are required for making a project, creating a proxy document (with video data), making and managing nodes (codes), and reporting the results were used as instrumentation of the content analysis following the guidelines of the

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manufacturers (QSR, 2002). *Node* is the word that NVIVO uses for *code* and it is intended to represent anything that project users may wish to refer to (Neuendorf, 2001). A data collection instrument (coding tree) was developed for describing different behaviors (Coleman, Stevenson, & Wilson, 2000) based on factors that were found in the literature review and seemed to contribute to a drowning incident (e.g., Table 1).

NVivo software allowed the examination of the coded text by using the coding stripes (a procedure of identifying differently coded sections visually) or using the Node Browser that compared internally all data that were similarly coded. Reviewing the coded text twice enabled the establishment of new relationships between nodes and structuring free nodes into tree nodes. As the coding procedure progressed, Nvivo was used to find areas in which themes overlapped by performing

Table 1 Environmental Factors That Affect Drowning Incidents

Aquatic Environment	
Specific geographical characteristics of the country	
garden pond	bath tub
lake	canal
sea	river, stream
swimming pool	dock
water park	harbor
Size/Shape of working area	
water depth	length of supervised aquatic area
water specific gravity	ground gradient
Indoor	
lighting	air quality
heating	water clarity
Outdoor	
flood	pollution
raining	water temperature
climate	reflection
waves	off shore winds
tide	weather
currents	
Social, emotional	
psychological pressure because of the public presence in emergency	
influence of other parties that desire to go over their limits	
noise during lifeguard scanning	
Political issues	
preventive measures	
legislation	
morality of selling policy regarding equipment	

Boolean searches with matrix intersection to find the intersection of the various variables. Once the nodes had been consolidated and structured, they were ready to be entered into the Nvivo Modeler for conceptual model building (Rich & Patashnick, 2002). Document Text Reports were made for each aquatic emergency including information about the project, the user, the data, document title, when it was created, modified, brief description, and a document text.

Observational content analysis of the video-recorded incidents enabled us to examine the drowning experience "from the inside out." The objective data that the videos captured were rich in information that other forms of data could not duplicate. An example of the rich information was the audiovisual record of a girl being submerged under the water for 4 min, as she wheezed and gasped for breath with her hair caught in the water suction valve of a whirlpool. Content analyses were dependent on the careful observation of the videos, the categorization of the frequency and nature of the verbal interactions, the data analysis, and the writing of a brief report with recommendations for future practice (Booth, 1998).

Study 1 Results

Table 2 summarizes the results of the study. It shows that drowning incidents were located in the following places: lakes (3, 7.31%), sea (29, 70.73%), swimming pool (1, 2.43%), rivers (5, 12.19%), stream (1, 2.43%), harbor (1, 2.43%), and domestic water (1, 2.43%). In terms of water depth, incidents occurred where the casualties were out of their depth (22, 95.6%) or in water where they could stand up (1, 4.3%), and at various distances from safety (ranging from 1m up to the open ocean but it could not specify precisely through visual observation). When the ground gradient in the aquatic areas was downhill drowning incidents were also present (e.g., in Orchard beach of USA). Drowning incidents leading to survival occurred in bad weather conditions like rain/snow (3, 11.5%), flood (3, 11.5%), off-shore winds (3, 11.5%), strong sea currents (5, 19.2%), waves (4, 15.4%), or in good environmental conditions (8, 30.7%). Preventative measures (13, 48.14%), the breach of law (3, 11.11%), and the violation of regulations in selling equipment (2, 7.4%) were factors that influenced the outcomes of drowning.

Study 2

Participants. With a combination of snowball and convenience sampling methods (Patton, 1990), we conducted semistructured interviews with 30 male and 4 female participants who were water safety or aquatic professionals (e.g., lifeguards, lifesavers, scuba divers, and athletes of aquatic sports) from various countries (Table 3). Participants provided institutional ethical informed consent to participate in semistructured interviews investigating the factors involved in drowning incidents.

Apparatus and Procedures. A Sanyo M-1110C audiotape recorder and 2-hr Maxell cassettes were used to record the interviews. Institutional ethical approval was first obtained to conduct semistructured interviews investigating the factors involved in drowning incidents. The people interviewed were involved in the drowning incidents they described. A snowball or chain sampling method was used to locate information-rich key informants and critical cases that either viewed

Table 2 Frequencies of the Variables that Constitute the Factor "Wherever" in the Examined Sample (n = 34)

Aquatic Environment	Frequencies
Specific geographical characteristics of the country	
Lake	2, 5.88%
Sea (beach)	23, 67.64%
Sea (under water)	5, 14.70%
Swimming pool	4, 11.76%
Size/shape of working area	
Water depth: casualty out of depth	27, 79.41%
Standing up level	3, 8.82%
Unspecified	4, 11.76%
Distance from safety 1–9 m	8, 30.8%
Distance from safety 10–50 m	8, 30.8%
Distance from safety 51–200 m	9, 34.6%
Distance from safety 201 m-ocean	1, 3.8%
Indoor-outdoor	
Air quality	2, 5.9%
Lighting	3, 9.0%
Waves	7, 20.6%
Currents	3, 9.0%
Off shore winds	1, 2.9%
Water temperature: cold	4, 11.8%
Water temperature: warm	7, 20.6%
Social, emotional	
Risk taking behavior	9, 26.5%
Risk due to presence of the public	1, 2.9%
Influence of others	2, 5.9%
Noise during lifeguard scanning	3, 9.0%
Political issues	
Preventative measures	18, 53.0%
Morality of selling policy regarding equipment	2, 5.9%

the footage or discussed their own experience (Patton, 1990). An information sheet was distributed to potential participants before the interviews explaining the nature and objectives of the study, and voluntary informed consent was obtained (Gratton & Jones, 2004). Interviews were conducted using a semistructured interview outline, which included points relating to each of the four factors of interest (i.e., the rescuer, the casualty, the location, and the circumstances). Confidentiality and anonymity were maintained throughout, and individuals were not identifi-

Table 3 Demographic Information of the Participants in the Interview (*n* = 34)

Gender	30 males (age 16–65 years, *M* = 28.4, *SD* = 11.3)
	4 female (age 19–65 years, *M* = 37.5, *SD* = 19.5)
Nationality	Greece (*n* = 25, 71.4%)
	United Kingdom (*n* = 2, 5.7%)
	United States (*n* = 1, 2.8%)
	Cyprus (*n* = 6, 17.1%)
Place of reported drowning	Sea (above the water surface; *n* = 23, 67.6%)
	Sea (under the surface of the water surface; *n* = 5, 14.7%)
	Lake (*n* = 2, 5.9%)
	Swimming pool or water park (*n* = 4, 11.8%)

able from the raw data (Patton, 1990). Data were transcribed and entered into NVIVO for indexing and qualitative content analysis (Wengraf, 2001). The procedures adopted were consistent with those used in Study 1. All hard copies were kept in a locked cabinet, and electronic data were password protected.

Study 2 Results

Table 4 summarizes the results of the study. It shows that drowning incidents were located in lakes (2, 5.88%), or in seas above the water (23, 67.64%), or under the water (scuba- and skin-diving; 5, 14.70%), and in swimming pools (4, 11.76%). Incidents occurred when the casualties were out of their depth (27, 79.41%) or in water where they could stand up (3, 8.82%) when the casualty had previous medical history (e.g., diabetic seizure, epilepsy, cardiac arrest). Most incidents (61.6%) occurred no further than 50 m from the safety, e.g., 1–9 m (8, 30.8%) and 10–50 m (8, 30.8%). Only a few incidents occurred at distances between 51–200 m from safety (9, 34.6%), and only one at a distance greater than 201 m (1, 3.8%).

When the air in swimming pools was not clear (2, 5.9%) and the lighting poor (3, 9%), drowning incidents were more likely, because the lifeguard was unable to detect a distressed person. Other well established in the lifesaving literature outdoor factors, such as off-shore winds (1, 2.9%), strong sea currents (3, 9%), and waves (7, 20.6%) contributed to drowning incidents in beaches and lakes. Water temperature was either cold (4, 11.8%) or warm (7, 20.6%) during some of the incidents. In some cases the influence of others affected the people that were in danger (2, 5.9%). If they were alone in the aquatic environment, it is likely that they would not participate in the activity that jeopardized their safety. Noise while the lifeguards scanned the water (3, 9%) was also a factor that affected their accuracy in detecting trouble. Preventative measures (18, 53%) and the lack of morality in selling appropriate equipment policy (2, 5.9%) were factors that affect the outcome of drowning.

Table 4 The Frequencies of the Variables that Constitute the Factor "Wherever" in the Examined Sample (n = 41)

Aquatic Environment	Frequencies
Specific geographical characteristics of the country	
Lake	3, 7.31%
Sea	29, 70.73%
Swimming pool	1, 2.43%
River	5, 12.19%
Stream	1, 2.43%
Harbor	1, 2.43%
Domestic water	1, 2.43%
Size/shape of working area	
Water depth: casualty out of depth	22, 53.65%
Standing up level	1, 2.43%
Unspecified	18, 43.90%
Distance from safety 1–9 m	14, 34.14%
Distance from safety 10–20 m	5, 12.19%
Distance from safety 21–500 m	3, 7.31%
Distance from safety 500 m-ocean	5, 14.63%
Outdoor	
Flood	3, 11.5%
Raining/snow	3, 11.5%
Waves	4, 15.4%
Currents	5, 19.2%
Off shore winds	3, 11.5%
Political issues	
Preventative measures	13, 48.14%
Breach of law	3, 11.11%
Morality of selling policy regarding equipment	2, 7.4%

Discussion

The aim of the current study was to identify where people drown; therefore, a discussion will need to focus, apart of the findings, on how those places of occurrence are likely to lead to drowning. More precisely, the variables that seemed to relate with drowning were the geographical characteristics of the country, the size and the shape of the working area, the distance from safety, indoor and outdoor factors, noise during lifeguard scanning, and political issues.

Specific Geographical Characteristics of the Country

The most common place of occurrence of a drowning incident was the sea, at the beach, or under the surface with skin- and scuba-diving. Other places of occurrence were lakes, swimming pools and water parks, domestic water in drainage pipe, the harbor, rivers, and streams. All those places are well reported in the related literature as places of occurrence of drowning (Mackie, 1999; Orlowski, 1987; Pearn et al., 1979; Royal Life Saving Society Australia, 2001a). It is understandable and expected that with a higher sample of videos or interviews, more aquatic locations (that now did not appear) would have been places of occurrence of a drowning incident.

Size/Shape of Working Area

It has been argued that water depth is the most important drowning consideration, particularly for weak and nonswimmers (Macdonald, 1999). Anyone can drown in 1.52 m of water or less (Avramidis, 1998; Griffiths, 2002). Therefore, it was not surprising the finding of the current study that show people being in difficulties while out of depth. According to others, drowning can also happen in as little as 2 cm of water depth (Ridder et al., 2002). Although our studies could not come to the same conclusion, it was interesting to see that some people experienced a drowning incident even when they could stand up in the water. This was likely to occur not because the people in distress were necessarily nonswimmers but because they had a previous medical history (e.g., diabetes, epilepsy, or heart disease). Therefore, for those with disabilities or other medical problems, an aquatic activity always carries the increased likelihood of a potential danger, regardless of the water depth because if they fall unconscious face down, even very shallow water can prevent air entering into the lungs.

Distance From Safety

People experienced drowning in all the examined distances (e.g., between 10–50 m, 51–200 m, and 201 m-ocean), indicating that people engaging themselves in activities near, on, under, or above the water can face an aquatic emergency at any distance from safety (shore or poolside). More importantly, when people travel in the air or in the space above the sea, it is still possible for them to experience a drowning incident if something goes wrong with their aircraft or craft. These findings were supported by Nemiroff (2006), who said that the frequency of immersion/submersion accidents and drowning fatalities when the wreckage is not floating after an air crash in Alaska could be even one per day.

In both studies, nearly one in every three casualties was in difficulty 1–9 m from safety. This finding contradicted previous reports that argued that 42% of drownings occur within 2 m of rescue, 55% within 3 m, and many in water only just deeper than the person's height (Stallman, 2008; Stallman, Junge, & Blixt, 2008), possibly because those studies examined only drowning incidents near the shore and not aquatic activities above or near the water (e.g., airplane crashes). The importance of our finding should be interpreted in relation to the fact that most of the lifeguard organizations include the 400 m timed swim as a test requirement for certifying a beach lifeguard (e.g., Avramidis, 2004a; Decree-Law, 2000; Wright, 2006), although in reality most of the incidents take part at much shorter distances. When the distance is greater than 200 m, then it might be appropriate to use other rescue methods (e.g., rescue board or power boat) rather than swimming to approach and rescue the casualty (Avramidis, 2008). Our findings suggest that the test requirements for the beach lifeguard qualification could be made less demanding without a loss of lifeguard quality, and therefore more candidates could pass the exams and work, increasing the likelihood of accident prevention. This is important because at the moment in many locations and facilities, there is a dramatic lack of people interested in working at beaches and other aquatic facilities (Wood, 1999).

Indoor-Outdoor Factors

Various indoor and outdoor factors appeared to be linked with the likelihood of drowning incidents. Because there must be adequate visibility for lifeguards to move around and supervise the aquatic activities, lighting is essential in water surveillance, and glare should be minimized so a lifeguard can see a swimmer on the pool bottom (Schwartz, 1998). Lifeguards cannot save what they cannot see. In this study, the interviewed professional lifeguards indicated the importance of the air quality and enough lighting while explaining how they dealt with aquatic emergencies occurring in swimming pools or whirlpools. Unfortunately, the water temperature and the effect of tides in those incidents occurring at the sea could not be estimated precisely in this study. Various outdoor factors well reported in previous studies (Alberts et al., 1989; Branche et al., 2001) like waves, currents, and off shore winds, were also present here while people faced a drowning incident. According to Greenhalgh (1997), floods lead to drowning for both inhabitants and even rescuers/lifeguards. Raining is related to floods and therefore can kill or drown many people at the same time (Avramidis, 2004b). In this study, flood and raining/snow were present during the drowning incidents. A literature search showed that cold water can hasten the process of causing immediate death due to cold shock response (Golden & Tipton, 2002), even to Olympic level swimmers (British Defense, 1990) within minutes of cold-water immersion (Golden & Hardcastle, 1982). One may, therefore, assume that when the water is warm, the danger is less. Indeed, although the danger of cold shock response doesn't exist, the likelihood of more mass exposure in water with engagement in different aquatic activities happens. Therefore, when the water is cold, fewer people will get in, but they are in danger of experiencing all the negative consequences of the low temperature; when the water is warm, many people will get in, increasing statistically the percentages of having a drowning incident. Thus, in the rescues that were described in the interviews, water temperature during the accident was either cold or warm.

Noise During Lifeguard Scanning

Noise distracts the lifeguard when scanning, thus not allowing a quality observation of the bathers (Coblentz et al., 2001; Ellis and Associates & Poseidon Technologies, 2001). Although only a few cases were reported here, it seems that noise might play a hidden role in the quality of the lifeguard vigilance. One lifeguard, who had to observe an overcrowded beach, characteristically commented, It was a simple enough rescue. That doesn't happen very often. It's a matter of chance if you notice it. A situation such as this may happen in the water and we may see it, or not. The same thing can happen in shallow water. There are so many people around and the beach so big that you might not notice. You see . . . people, so many heads. . . . You are in a position, seeing how people move, how people act, without being certain if someone is drowning. (Interview 7, Section 0, Paragraph 6)

Political Issues

Preventative measures (e.g., safety rules enforcement, presence of lifeguard, use of equipment, or warning signs, etc.) appeared to be present in two-fifths of the reported incidents. This is an important finding, because sometimes several aquatic facilities don't even have lifeguards and have to close the facility (Griffiths, 2001a). According to the same author, the law does not require guards in other aquatic areas. In addition, it seems that sometimes people even breach the existing law by engaging in illegal aquatic activities (e.g., stowaways try to escape from a river to another country, stuntmen perform risk taking activities, base jumpers; see Sapkota et al., 2006). Finally, the failure to abide by a policy regarding equipment was connected with drowning incidents. The lack of quality of some equipment (e.g., flotation ring, mask, and badly maintained scuba diving oxygen cylinder before sale) was the cause of drowning in the some cases, but fortunately the intervention of the lifeguard or the self-control of the casualty saved the victims. This finding agrees with the ones from the research in European Union Countries, which found that equipment represents a factor that can cause drowning (Apostolakis, 2002).

Need for Additional Research

Further research is required to replicate the current findings. The current findings are subject to a number of different sources of potential bias. For example, those interviewed may struggle to remember specific details about the drowning incident, and their perceptions are likely to have been influenced by the stressful nature of the situation. Considerable time may also have passed between the drowning incident and the interview (Avramidis, Butterly, & Llewellyn, 2007).

These findings have important implications for the lifeguard organizations, the local authorities, and the general public as they show the potential places where a drowning incident might take place. The present findings suggest the importance of water safety awareness on all the above issues. The lifeguard organizations should make educational initiatives like campaigns, leaflets, and lectures in an attempt to educate the general public. Local authorities have a responsibility to make funding available where possible for providing enough and quality lifeguard cover even in areas that in the past seemed to be save. Finally, the general public should be more safety conscious and aware of the potential dangers that the various aquatic places might hide.

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Conclusions

According to the 4W model of drowning, the third factor that determines the outcome of a drowning incident is the place of occurrence. Based on the findings of the current study, it is concluded that drowning incidents may occur in any aquatic environment with a water depth that allows immersion or submersion, in a variety of environmental conditions, where the ground is sloping, at any distance from safety, where anxiety is caused, in the absence of safety regulations, or when the law is breached. These findings should be taken into account by lifeguard organizations, local authorities, aquatic safety professionals, and the general public.

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